

# Use of Spirometry in the Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease in Primary Care

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**OBJECTIVE:** The aim of this study was to assess the use of spirometry for the diagnosis and follow-up of patients with chronic obstructive pulmonary disease (COPD) in primary care in terms of deficiencies and the requirements for its correct use, and to identify the regimens most commonly used in patients with COPD.

**METHODS:** The study included 839 primary care physicians, each of whom completed 2 questionnaires, one on treatment of COPD and the other on the use of spirometry for diagnosis and follow-up of the disease.

**RESULTS:** Notable among the results was the high number of questionnaires in which no response was given to the question on classification of patients according to severity of airway obstruction (10.7% of cases) and the low number of correct responses to questions on treatment with bronchodilators during the stable phase of COPD (15.1%). The highest rate of correct responses was for questions regarding the indication for spirometry, all of which were answered correctly in more than 60% of cases. Only 59.2% of primary health care centers performed spirometry, mainly due to a lack of training. In more than 30% of cases the nursing staff had not received specific training, a finding that was reflected in the poor compliance with guidelines for calibration (10.9% of health care centers performed daily calibrations), cleaning of the spirometer (in 13.9% of cases the equipment was never cleaned), and providing patients with pretest recommendations (30% did not provide recommendations the day before spirometry).

**CONCLUSIONS:** Primary care physicians are aware of the usefulness of spirometry for the diagnosis and follow-up of COPD. Although they are able to recognize airflow obstruction, they do not classify patients correctly in terms of severity. Very limited availability of spirometry was observed in primary health care centers and there was little training in the use of the technique, a finding reflected in the poor compliance with guidelines for its use.

**Key words:** Chronic obstructive pulmonary disease. Diagnosis. Treatment. Primary health care. Spirometry.

Utilización de la espirometría en el diagnóstico y tratamiento de la EPOC en atención primaria

**OBJETIVO:** El objetivo del estudio ha sido evaluar las deficiencias y necesidades para la correcta utilización de la espirometría en el diagnóstico y seguimiento del paciente con enfermedad pulmonar obstructiva crónica (EPOC) en atención primaria (AP) y conocer las pautas habituales de tratamiento de esta enfermedad.

**MÉTODOS:** Participaron 839 médicos de AP y cada uno de ellos cumplimentó 2 cuestionarios, uno sobre el tratamiento de la EPOC y otro de utilización de la espirometría en su diagnóstico y seguimiento.

**RESULTADOS:** Destacó el bajo índice tanto de respuestas a la pregunta sobre la clasificación de los pacientes en función de la gravedad de la obstrucción (no respondió el 10,7%) como de respuestas correctas en las preguntas sobre el tratamiento broncodilatador en fase estable (respuestas correctas: 15,1%). Las mayores tasas de respuestas correctas se obtuvieron en las preguntas referentes a la indicación de la espirometría, todas ellas con un índice de acierto superior al 60%.

Sólo un 59,2% de los centros de AP realizaban espirometrías, sobre todo debido a la falta de formación. En más de un 30% de los casos el personal de enfermería no había recibido formación específica, lo que se reflejaba en un escaso seguimiento de las normativas en cuanto a calibración (un 10,9% de los centros la realizaba diariamente), limpieza de los aparatos (un 13,9% no la hacía nunca) y recomendaciones al paciente (un 30% no daba recomendaciones el día antes).

**CONCLUSIONES:** Los médicos de AP conocen la utilidad de la espirometría en el diagnóstico y seguimiento de la EPOC. Identifican la presencia de una obstrucción al flujo aéreo, pero no se clasifica correctamente a los pacientes en función de su gravedad. Se ha observado una escasa disponibilidad de la espirometría en los centros de AP, así como una escasa formación en su manejo, lo que se refleja en un escaso seguimiento de las normativas de realización de la prueba.

**Palabras clave:** EPOC. Diagnóstico. Tratamiento. Atención primaria. Espirometría.

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## Introduction

Chronic obstructive pulmonary disease (COPD) is a major public health problem throughout the world. In spite of antismoking campaigns, the prevalence and mortality rates of COPD continue to rise every year.

The World Health Organization estimates that COPD is currently the fourth most common cause of death in the world and that by 2020 it will be the fifth most common cause of disability and the third most common cause of death.<sup>1</sup> One of the factors accounting for the change is a marked increase in smoking, especially amongst women. In Spain, the prevalence of smoking in women between 20 and 40 years old is similar to that of men of the same age.<sup>2</sup> Coupled with the greater susceptibility of women to adverse effects of tobacco smoke,<sup>3</sup> those findings suggest that an increase in the prevalence of COPD can be expected in women.

The results of the IBERPOC study indicate a prevalence for COPD of 9.1% in the Spanish population aged between 40 and 70 years.<sup>4</sup> The same study showed that 78% of patients with COPD are not diagnosed and that 60% of patients diagnosed with the disease are not treated according to established guidelines. The best approach to reducing costs arising from COPD would be to diagnose it early and to manage it well in the early stages.<sup>5</sup> On the basis of such observations, it is apparent that primary care physicians must be involved in the detection of cases and that initiatives must be developed to improve the care of patients with COPD by providing information and encouraging good practice.

To determine the current status of diagnosis and treatment of COPD patients in primary care, 2 questionnaires were designed, one relating to treatment of the disease and the other to the use of spirometry for its diagnosis. A sample of primary care physicians distributed throughout Spain was invited to complete the questionnaires in this survey.

## Methods

### Study Design

The aim of the present study was to assess diagnosis and treatment of patients with COPD in primary care settings. A sample of primary care physicians was generated by inviting doctors from all Spanish autonomous communities to participate based on random selection from a database prepared by the companies that funded the study. When a doctor refused to participate, another was chosen at random from the database and invited. The surveys formed part of a more extensive training program that included the review of clinical cases to assess diagnostic approaches to hypothetical cases of COPD in both sexes.<sup>6</sup> The sessions took place between November 2003 and April 2004.

The questionnaire on the management of COPD contained 9 test questions, each with 5 possible responses, only one of which was correct. The questions tested knowledge of various aspects of the diagnosis of COPD, indications for the use of spirometry, identification of the different spirometry patterns, classification of COPD patients according to severity of obstruction, and treatment of COPD in the stable phase (Appendix 1).

The second questionnaire focused on the use of spirometry in primary care for the diagnosis and follow-up of patients with COPD. It contained 10 questions with a varying number of possible responses designed to identify problems and failings in the diagnosis of COPD in primary care, the availability and use of spirometry, the personnel who performed spirometry and the training they had received in its

use, and compliance with recommendations and guidelines on the use of spirometry (Appendix 2).

The results of the 2 surveys are shown in frequency tables.

## Results

A total of 839 primary care physicians from all 17 Spanish autonomous communities participated in the study and their geographic distribution was proportional to the number of doctors in each autonomous community. All 839 questionnaires on the use of spirometry were obtained for analysis and 807 (96.1%) questionnaires were returned on management of COPD.

### Management of COPD in Primary Care

The questions that were most often left unanswered were question 9, on the indication for arterial blood gas analysis in COPD (13.9% did not respond), and number 7, which related to the classification of COPD on the basis of the severity of obstruction detected by spirometry (10.7% did not respond)—the physicians correctly identified the presence of airflow obstruction but did not correctly classify the patients in the different stages. The response rate for the remaining questions was higher than 92%.

The questions for which the lowest percentage of correct answers were obtained were question 8, regarding treatment with bronchodilators in COPD (15.1%), question 9, on the indication for analysis of arterial blood gases in the stable phase of COPD (45.7%), and question 3, relating to the correct use of the expiratory maneuver (46.1%).

The questions for which the highest rates of correct responses were obtained were those related to the indications for spirometry, all of which had more than 60% correct responses. These results indicate that the primary care physicians identified the group of at-risk individuals in whom screening for the disease was necessary, in addition to recognizing the usefulness of spirometry for the diagnosis and follow-up of patients with COPD.

Only 6 of the participants (0.7%) provided correct answers to all 9 questions (Table 1), while 61.5%

TABLE 1  
Questionnaire on the Management of COPD:  
Number of Questions Answered Correctly (n=807)\*

Number of Correct Responses	Number	%	Cumulative %
0	4	0.5	0.5
1	9	1.1	1.6
2	26	3.2	4.8
3	97	12.0	16.8
4	175	21.7	38.5
5	184	22.8	61.3
6	158	19.6	80.9
7	104	12.9	93.8
8	44	5.5	99.3
9	6	0.7	100.0

\*COPD indicates chronic obstructive pulmonary disease.

TABLE 2  
Results of the Questionnaire on Management of COPD in Primary Care (n=807)\*

Question (Correct Response)	Correct Responses	Most Frequent Incorrect Response	No Response
1. Knowledge of spirometry patterns (c)	450 (57.2%)	b (31.1%)	2.6%
2. Uses of spirometry in the diagnosis and follow-up of COPD (e)	678 (84.9%)	b (7.6%)	1.1%
3. Spirometry maneuver technique (d)	344 (46.1%)	c (27.5%)	7.7%
4. Indications for screening of COPD by spirometry (e)	507 (63.7%)	b (19.6%)	1.5%
5. Diagnostic approach to COPD (d)	755 (93.7%)	e (3.9%)	0.25%
6. Bronchodilator treatment in the stable phase of COPD (c)	474 (60.1%)	d (20.3%)	2.4%
7. Classification according to severity of obstruction (b)	416 (57.7%)	c (37.7%)	10.7%
8. Treatment in the stable phase of COPD (c)	112 (15.1%)	b (34.1%)	8.3%
9. Indications for blood gas analysis in COPD (c)	318 (45.7%)	b (23%)	13.9%

\*COPD indicates chronic obstructive pulmonary disease.

gave correct responses to 5 or more questions. The results obtained with this questionnaire are shown in Table 2.

#### Use of Spirometry in Primary Care

Only 59.2% of all health care centers performed spirometry and 57.8% of the surveyed doctors had access to spirometry in their day-to-day practice. Of the 40.8% of doctors who did not perform spirometry in their clinic, the majority sent patients to the regional specialist for the test to be performed (85.6%). When asked why spirometry was not used, in 35.1% of cases, respondents reported that it was due to a lack of training. Other reported causes were the lack of availability of dedicated staff (21.4%) and lack of time (19.9%), while up to 10.6% of the doctors reported that despite having a spirometer they preferred to send cases to the regional specialist.

A total of 58.3% of the questionnaires from participants who reported that spirometry was performed in their health care center indicated that the procedure was undertaken by dedicated nursing staff. However, when asked about the training received in performing spirometry, 31% reported that no specific training in the form of a workshop or a rotation in a pulmonary function laboratory had been provided.

In terms of the correct use of spirometry, it is noteworthy that calibration was performed in 75% of health care centers but only 10.9% reported undertaking daily calibration, more than 40% performed calibrations no more than monthly, and 20.2% reported never having calibrated the equipment. In 13.9% of cases the spirometry equipment was never cleaned and in more than 50% it was cleaned no more than monthly. Finally, 30% of the surveyed primary care physicians admitted not providing recommendations to patients the day before the test. The details of the results obtained are shown in Table 3.

#### Discussion

The results of both surveys show that primary care physicians are able to identify at-risk individuals in

whom screening for COPD should be performed and that they recognize the usefulness of spirometry in the diagnosis and follow-up of those patients. They correctly identify the presence of airflow obstruction but do not correctly classify patients in the different stages. There appears to be a lack of clarity on the drugs to be used as a first choice and on the subsequent use of a treatment scale.

The results showed limited availability of spirometry in primary health care centers. The centers that had a spirometer available often did not use it due to lack of staff training. In many cases the nursing staff who performed the test had not received specific training, a finding that was reflected in the poor compliance with guidelines, both for calibration and cleaning of the apparatus, and in the provision of patient recommendations.

Despite the availability of data such as that provided by the IBERPOC study, which reported a prevalence of 9% for COPD in the general population of Spain aged between 40 and 70 years,<sup>4</sup> many patients are still not diagnosed throughout a major part of the course of the disease and often require medical care when they have already lost close to half of their respiratory capacity.<sup>7</sup> Various studies have demonstrated the usefulness of screening for COPD by spirometry in primary care and highlight the need to take active measures to ensure early detection of the disease.<sup>8-12</sup> The high level of underdiagnosis mentioned makes such programs both possible and necessary.

Our correct response rates to questions on the indication for spirometry in the diagnosis of COPD were higher than those of a North American study in which it was reported that the test was initially only requested in 22% of cases<sup>13</sup> and those of another study published in Spain in 1994 in which only 36.4% of primary care physicians requested spirometry in patients with suspected COPD.<sup>14</sup> This change may reflect an increased interest in COPD among primary care physicians in recent years and improved familiarity with recently published and publicized guidelines. However, we can not rule out the possibility of a positive bias given that the doctors knew they were going to participate in a survey related to COPD.

TABLE 3  
Results of the Questionnaire on the Use of Spirometry in Primary Care (n=839)

Question	Most Frequent Response
1. Spirometer availability	Yes (57.8%)
2. Use of spirometry in the health care center	Yes (59.2%)
3*. Reasons for not using spirometry	Lack of time (19.9%) Lack of training in the procedure (35.1%) Lack of dedicated staff (21.3%) Other reasons (23.7%)
4. Who performs spirometry?	The nurse for each surgery (32.3%) The nurse responsible for spirometry (58.3%) The doctor and nurse for each surgery (5.9%) Other possibilities (3.5%)
5. Training in performing spirometry	Yes (69%)
6. Is the spirometer calibrated?	Yes (74.7%)
7. Frequency of calibration	Each day (10.9%) Each week (10.9%) Each month (15.3%) Every few months (27.9%) Unknown or not answered (63.1%) Never (20.2%)
8. How often is the spirometer cleaned?	Each week (34.9%) Each month (19.1%) Every few months (16.7%) Unknown (15.3%) Never (14%)
9. Recommendations given to the patient the day before the test	Yes (67.5%)
10. If spirometry is not performed, what action is taken?	Referred to the regional specialist (85.7%) Spirometry not requested (7.4%) Other (7%)

\*If no response is given, it is understood that a spirometer is available and is used.

### Recognition of Different Degrees of Obstruction

A large proportion of the participating doctors identified the presence of airflow obstruction but did not then correctly classify patients into different stages on the basis of severity of obstruction (values for forced expiratory volume in 1 second, FEV<sub>1</sub>). Correct interpretation of spirometry data is also crucial and it has been observed that COPD is diagnosed more often in patients when the results show severe obstruction than when the obstruction is moderate.<sup>6</sup> The efficacy of COPD screening programs is highly compromised if primary care physicians do not recognize the disease in the initial stages of airflow obstruction. The IBERPOC study demonstrated that the severity of COPD measured on the basis of FEV<sub>1</sub> has a significant independent association with the probability of having been diagnosed with COPD prior to participation in the study.<sup>15</sup> Primary care plays a particularly important role in COPD screening since it provides an opportunity to detect symptoms early, confirm diagnosis by spirometry, and establish the initial preventative or therapeutic measures that are considered appropriate.

### Bronchodilator Treatment in the Stable Phase of COPD

There does not appear to have been a clear consensus on the drugs of choice for the treatment of stable COPD

nor in the subsequent use of a treatment scale based on the severity of the disease, since a high variability was observed in the choice of possible responses to the 2 questions relating to those points. In the section on long-acting bronchodilators, a higher proportion of responses indicated the use of  $\beta$ -agonists than anticholinergic drugs. In the IDENTPOC study, differences in prescription practice were observed between the two care settings: greater prescription of inhaled short-acting  $\beta$ -agonists was seen in primary care and of anticholinergic drugs in pulmonology.<sup>16</sup> Taken together, perhaps the most noteworthy observation was that in primary care settings there were almost no differences in prescription habits according to the severity of COPD, the degree of dyspnea, or the quality of life of the patients, while in pulmonology the differences were more marked, leading to the conclusion that the treatment regimens used in specialized care are closer to current guidelines than those used in primary care.

### Spirometry

It was observed in this study that only around half of the health care centers had access to a spirometer. Of those centers that had a spirometer but did not use it, 35% did not do so due to a lack of training in its use.

Up to a third of the nursing staff who perform spirometry had not received appropriate training, a finding which is reflected in the poor compliance with guidelines on its use.

Various studies have demonstrated the importance of training and instruction in the use of spirometry.<sup>9, 17-19</sup> In a study undertaken with 30 primary care physicians it was observed that in most cases spirometry performed in primary care did not meet criteria for acceptability and reproducibility, although in a subset of doctors who had received training a clear improvement was observed in the use and interpretation of the maneuvers.<sup>17</sup> Other European studies have demonstrated that with a specific training program the quality of spirometry in primary care could be similar to that of pulmonary function laboratories.<sup>9,18</sup>

In the majority of health care centers with a spirometer, there is no individual specifically responsible for performing the test, and furthermore, periodic quality control is not undertaken to assess the reliability of the results. In the IDENTEPOC study, only 29.9% of health care centers had a professional responsible for performing the test, compared with 97.8% in specialized care settings, and only 22.2% of the health care centers with a spirometer performed any type of quality control, compared with 88.6% in pneumology departments.<sup>16</sup> Those findings are similar to the results obtained in another study which sought to assess treatment of chronic bronchitis and COPD in primary care and showed that only 47% of the patients assessed had previously undergone spirometry.<sup>20</sup> In that study it is also noteworthy that patients with the same indicators of severity but without functional testing in their normal follow-up presented more exacerbations and generated more visits to the emergency department and their own general practitioner than patients in whom those tests were used in their management and follow-up. In addition, performing spirometry as part of patient follow-up is associated with a reduced cost due to the use of treatments that are more consistent with guidelines and recommendations.<sup>21</sup>

The dissemination of guidelines for diagnosis and treatment of COPD in primary care should be a fundamental objective for the improvement of day-to-day health care for those patients. New strategies should be developed to improve the use of spirometry in primary care and to investigate new training possibilities in this area.

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APPENDIX I  
Questionnaire on the Management of COPD\*

1. COPD is associated with an obstructive spirometry pattern. When would a pattern be considered obstructive?
  - a)  $FEV_1 > 70\%$  and  $FEV_1/FVC < 70\%$
  - b)  $FEV_1 < 70\%$  and  $FEV_1/FVC < 80\%$
  - c)  $FEV_1 < 80\%$  and  $FEV_1/FVC < 70\%$
  - d)  $FEV_1 < 70\%$  and  $FEV_1/FVC > 70\%$
  - e) None of the above
2. Spirometry is used for:
  - a) Diagnosis of COPD
  - b) Diagnosis and assessment of disease course
  - c) Assessment of treatment effectiveness
  - d) Estimation of prognosis
  - e) All of the above
3. How many seconds does forced expiration have to last in spirometry for the maneuver to be considered valid?
  - a)  $> 3$  s
  - b)  $> 4$  s
  - c)  $> 5$  s
  - d)  $> 6$  s
  - e)  $> 7$  s
4. In whom should forced spirometry be performed to rule out COPD?
  - a) All individuals aged more than 40 years
  - b) All individuals aged more than 40 years who are exposed to risk factors (smoking)
  - c) All individuals aged more than 40 years with dyspnea
  - d) All individuals aged more than 40 years with cough and expectoration
  - e) All individuals aged more than 40 years who are smokers and present any respiratory symptoms
5. In the following case, what attitude would you adopt? The patient, aged 45 years, is a smoker with a smoking history of 20 pack-years and presents with cough and mucoid expectoration with upper airway involvement. He maintains a normal lifestyle and performs his work in an office normally, although he recognizes that he does not undertake any physical exercise. He was surprised to notice that he was short of breath when climbing 2 flights of stairs the day before because the lift in his building was broken. This frightened him and he decided to see the doctor.
  - a) Refer him to a pulmonologist
  - b) Refer him to a cardiologist
  - c) Attribute the problem to smoking
  - d) Treat the acute symptoms and make an appointment to address the patient's smoking and assess lung function
  - e) Request an electrocardiogram and a chest radiograph
6. In the case of the patient described in question 5, what treatment would you choose?
  - a) Inhaled corticosteroids
  - b) Antibiotics
  - c) Short-acting bronchodilators
  - d) Long-acting bronchodilators
  - e) Theophyllines
7. What is the interpretation of the following spirometry results obtained for the follow-up of a patient diagnosed with COPD?  $FEV_1$ , 1.3 L (44%); FVC, 2.1 L (77%);  $FEV_1/FVC$ , 56%. Bronchodilator test, 5% increase.
  - a) Mild airflow obstruction
  - b) Moderate airflow obstruction
  - c) Severe airflow obstruction
  - d) Airflow restriction but not obstruction
  - e) Normal
8. A patient diagnosed with COPD with an  $FEV_1$  55% of theoretical who has been treated with a combination of an anticholinergic drug and a short-acting  $\beta$ -agonist every 6 hours does not achieve control of his or her symptoms. What treatment would you use?
  - a) Maintain the same treatment and add an inhaled corticosteroid
  - b) Maintain the same treatment and add a long-acting  $\beta$ -agonist
  - c) Change to a long-acting anticholinergic drug
  - d) Change to a combination of an inhaled corticosteroid and a long-acting  $\beta$ -agonist
  - e) Add theophyllines
9. In a patient with COPD, when would you request analysis of blood gases?
  - a) When the patient has frequent exacerbations
  - b) In the initial assessment of the patient
  - c) When the patient's  $FEV_1$  is less than 1 L
  - d) Once per year
  - e) Following hospital admission

\*COPD indicates chronic obstructive pulmonary disease; FVC, forced vital capacity;  $FEV_1$ , forced expiratory volume in 1 second.

APPENDIX 2

**Questionnaire on the Use of Spirometry for the Diagnosis and Follow-Up of Patients With COPD\***

<p>1. Do you have access to a spirometer?  a) Yes  b) No</p> <p>2. Is spirometry performed in your health care center?  a) Yes  b) No (go to question 10)</p> <p>3. If you have access to a spirometer and do not use it, it is because  a) I do not have time  b) I am not trained in its use  c) There are no nursing staff who perform or know how to perform spirometry  d) Other reasons.....</p> <p>4. Who performs spirometry in your health care center?  a) The nurse for each surgery performs their own  b) There are 1 or 2 nurses responsible for all spirometry in the health care center  c) The doctor and nurse for each surgery  d) Other possibilities.....</p> <p>5. Have the individuals responsible for performing spirometry received specific training (workshop or rotation in a pulmonary function laboratory) in performing the technique?  a) Yes  b) No</p>	<p>6. Is the spirometer calibrated?  a) Yes  b) No</p> <p>7. How often is calibration undertaken?  a) Each day  b) Each week  c) Each month  d) Every few months  e) With a different frequency.....  f) Never</p> <p>8. How often is the equipment cleaned?  a) Each week  b) Each month  c) Every few months  e) With a different frequency.....  e) Never</p> <p>9. Is the patient given any recommendations the day before spirometry is performed?  a) Yes  b) No</p> <p>10. If spirometry is not performed  a) It is requested as a referral to the regional hospital/specialist  b) It is never requested  c) Other possibilities.....</p>
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\*COPD indicates chronic obstructive pulmonary disease.